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EARTHQUAKES LOCATED BY *T* PHASES DURING THE VELA UNIFORM ALEUTIAN ISLANDS EXPERIMENT, 1964

By
ROCKNE H. JOHNSON

DECEMBER 1964

TECHNICAL SUMMARY REPORT NO. 7

Prepared for
ADVANCED RESEARCH PROJECTS AGENCY
UNDER CONTRACT NO. Nonr-3748(01)
ARPA ORDER NO. 210-62 AMENDMENT
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HAWAII INSTITUTE OF GEOPHYSICS
UNIVERSITY OF HAWAII

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George P. Woollard

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Contents

ABSTRACT

This report tabulates sources and strengths of earthquake T phases recorded by hydrophone net during the VELA UNIFORM Aleutian Islands Experiment (August-September, 1964). In a thirty-seven day period, 654 earthquake locations were found for the entire Pacific, of which 184 were in the Aleutians. Comparison of T-phase strengths with earthquake magnitudes suggests a threshold about magnitude three for location by hydrophone net.

Introduction

An extensive underwater detonation program was undertaken in August and September 1964, for the primary purpose of calibrating a network of land and ocean-bottom seismographs established in the Aleutian Islands (Gerlach, 1964). The actual period of detonations was 30 August to 21 September, 1964 (Gray and Tocher, 1964).

The *T*-phase project at the Hawaii Institute of Geophysics is commencing a routine program for the determination of *T*-phase sources by means of arrival times at a SOFAR hydrophone network. These determinations will be published at regular intervals as the program becomes operational. Because of the special interest in Pacific seismicity during the VELA UNIFORM Aleutian Islands Experiment, those events located for the period 15 August to 21 September, 1964, are listed in this report.

Computational Method

The tabulated solutions were obtained on the IBM 7040 computer at the University of Hawaii Statistical and Computing Center. The computer program is in the process of refinement and will be the subject of a later report. It will be discussed only briefly in this report.

The program obtained, by iteration, the geographic position which gave the minimum variance for a set of origin times as computed for the *i*th hydrophone by the formula:

$$H_i = T_i - \frac{S_i}{V_{ki}}$$

for origin time H, arrival time T, distance to the hydrophone S, and average velocity V between region k and the hydrophone.

Seismic belts in the Pacific were divided into 29 regions for the purpose of indexing SOFAR velocity. The sets of velocities assigned each region were determined by explosion travel-time calibration where possible and from hydrographic data where explosion calibration was not available (Johnson and Norris, 1964). Regions where explosion calibrations were available are the Andreanof Islands (Aleutians), Hawaii, and California.

T-Phase Strength

A power level, in decibels relative to 0.1 microbar, is listed as a measure of T-phase strength. This level is calculated for a distance of 30 degrees from the source. The level measured at each hydrophone is reduced to that distance by the formula:

$$L_{30^\circ} - L_\theta = 10 \log \frac{\sin \theta}{\sin 30^\circ} + A(\theta - 30^\circ)$$

where θ is the distance in degrees from the source to the hydrophone; L_{30° and L_θ are the peak levels, in decibels, at distances of 30° and θ; and A is the attenuation equivalent to 1.6 db per megayard. On the righthand side of this equation, the first term accounts for spatial spreading over the earth's surface (cylindrical near the source), and the second term accounts for losses as measured in the Atlantic by Urick (1963). Signals from impulsive sources, as explosions, would require a third term to account for time spreading of the SOFAR signal (Urick, 1963); however, for T phases, the source is extensive in both time and space and the effective duration of the peak is of the same or greater order than the rise time. Therefore, time spreading does not significantly reduce the peak level of T phases. As the hydrophones and amplifiers used shift the peak of the T-phase power

spectrum to about 10 cps, this frequency was used in calculating loss and in referring the recorded level to pressure.

In many cases, the level measured at a particular hydrophone is influenced strongly by shadowing from local features. In tabulating a strength for a particular T phase, the level for each hydrophone was reduced to the standard distance and the hydrophone giving the maximum level was selected as being the least influenced by local features and therefore the most representative. It should be noted that no allowance is made for differences in efficiency between the various propagation paths nor for variation in radiated energy with azimuth at the source.

The most obvious flaw in this system is that it is too sensitive to human error. It is noted that several events are listed at strengths of 80 db or more. As these levels exceed the dynamic range of the recording equipment, they should be disregarded. The method of computing T-phase strength will probably be revised in the near future.

The relationship between T-phase strength and earthquake magnitude is, as yet, obscure. It appears that the strength of the T phase is heavily influenced by the location of the earthquake focus relative to continental, island, or seamount slopes (Johnson et al, 1963: Northrop, 1964).

Method of Analysis

The T-phase source is considered to be that area of the ocean bottom from which acoustic energy is radiated into the SOFAR channel. As the mathematical solution attempts to find a point source, its position may be at variance with that of the radiator. Neither of these positions will

necessarily coincide with the earthquake epicenter as one radiator may serve f epicenters throughout a given region. For a single earthquake, multiple peaks in the T phase is assumed to represent multiple radiators. Presumably, a separate T-phase source location could be established for each peak. Multiple radiators are identified and distinguished from multiple earthquakes, by noting that the peak spacing varies from hydrophone to hydrophone.

The appearance of the T-phase power-level record varies considerably from event to event and less so from hydrophone to hydrophone. To insure reliability of identification of corresponding events, all records are viewed in synchrony on table modified for this purpose. The time normally read is that of the peak power level. This peak may be quite sharp for some events or quite broad for others. For events with multiple peaks, that peak is read which appears to be best identified with peaks recorded at other stations. This peak may not be the highest at all stations. In fact, if a minor peak is sharper at all hydrophones, it will be preferred as giving the least uncertainty of arrival time.

The charts were recorded at a speed of 0.25 mm/sec from Pacific Missile Range hydrophones near Eniwetok, Wake, Midway, and Oahu. For some events, arrival times at a California hydrophone were included. All the hydrophones are placed at or near the depth of minimum sound velocity, the axis of the SOFAR channel.

Results

For the entire Pacific area, 654 sources of earthquake T phase were located. This is an average of about eighteen per day for the 37-day period. Of these, 184 were from the Aleutian area. The Aleutian events are listed

in Table I and the remaining events in Table II. An explanation of the tables is on page 11 which precedes Table I.

The geometry of the fixes, with hydrophones in the center of the Pacific and sources around the perifery, gives an area of uncertainty which is usually elongated on an axis normal to the Pacific rim. The degree of elongation varies inversely with the distribution in azimuth of the hydrophones. For some areas, notably Central and South America, the distribution in azimuth was seldom sufficient to obtain satisfactory fixes.

In a few cases, where it was desired to report the detection of T phases from an earthquake but a satisfactory fix could not be obtained, the nearest likely position is listed in the tables. These cases are recognized by the tabulation of time to whole minutes and of position to whole degrees.

T phases from the Gulf of Alaska area are not sharply received at Wake and Eniwetok because of the shadow cast by Kodiak Island. Although Midway and Oahu received many T phases from this area, the sources could not be satisfactorily fixed without reference to arrival times at a California hydrophone.

An unexpected degree of precision was obtained in locating two earthquakes in the South Pacific Cordillera. These events, numbers 440 and 441 of Table II, were about 95° (two hours travel time) from all hydrophones, including the one at California. The Coast and Geodetic Survey reported the epicenters at 49.5 S, 116.2 W, and 49.6 S, 116.2 W. The T-phase fixes, both at 49.3 S, 116.5 W, were about 0.3° from these positions. The T-phase origin times averaged 11 seconds later than the listed earthquake origin times.

Velocities used in this calculation were obtained by averaging across the SOFAR velocity chart of the Pacific Ocean (Johnson and Norris, 1964).

Detection in the southwestern Pacific was spotty, due, primarily, to the number of intervening islands between sources and receivers. Results in this area should be interpreted very cautiously.

Aleutians

Generally good results were obtained in the sector from the Alaska Peninsula to Japan. The events listed in Table I (Aleutians) are plotted in Figures 1 and 2. Locations are indicated by the serial number from the table. Circled numbers indicate the epicenters for corresponding events reported by the Coast and Geodetic Survey.

The positions lie generally farther north than would be expected from bathymetric considerations. This systematic error may be ascribed to the areal extent of the T-phase radiator which makes the computed point source appear behind the Aleutian slope.

About 76 events, nearly half of those for the entire Aleutians, are from a source off Unalaska Island. This area is plotted on an enlarged map in Figure 3. It may be assumed that these events were actually all from one radiator and that the observed scatter is an indication of the relative accuracy of the fix. Accordingly, the mean latitude and standard deviation was calculated for all fixes lying between 166 W and 168 W which are located by six or more hydrophones and with standard deviations of origin time less than 5.3 seconds. Fifty-seven events, ranging in latitude from number 7 to number 91, fell within these criteria. The mean latitude was 53.25 N with a standard

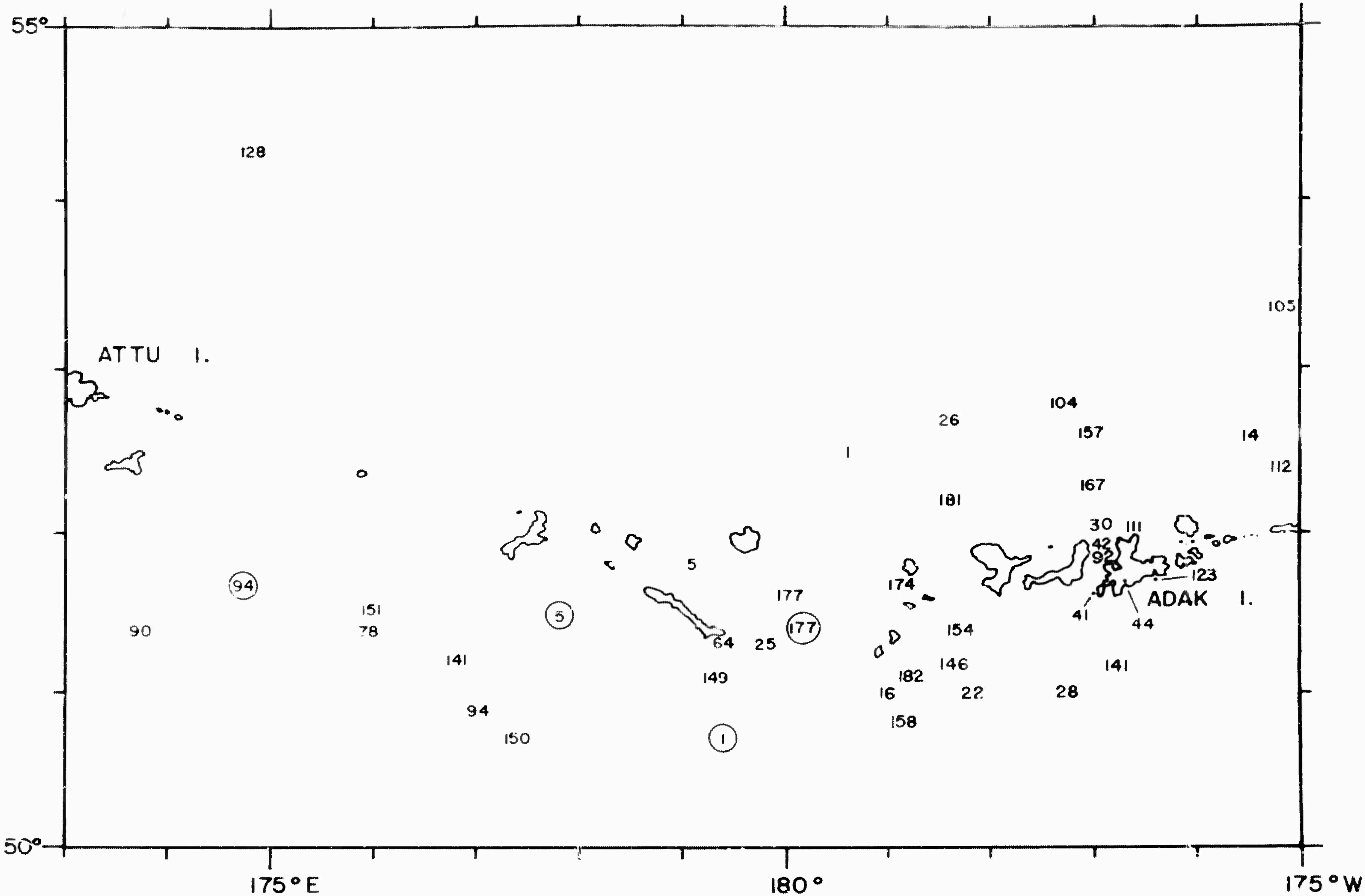

FIG. 1. T-phase source locations for the Aleutians between longitudes 175 W and 173 E. Numbers correspond to serial numbers in column 1 of Table I. Circled numbers are corresponding earthquake epicenters from Table IV.

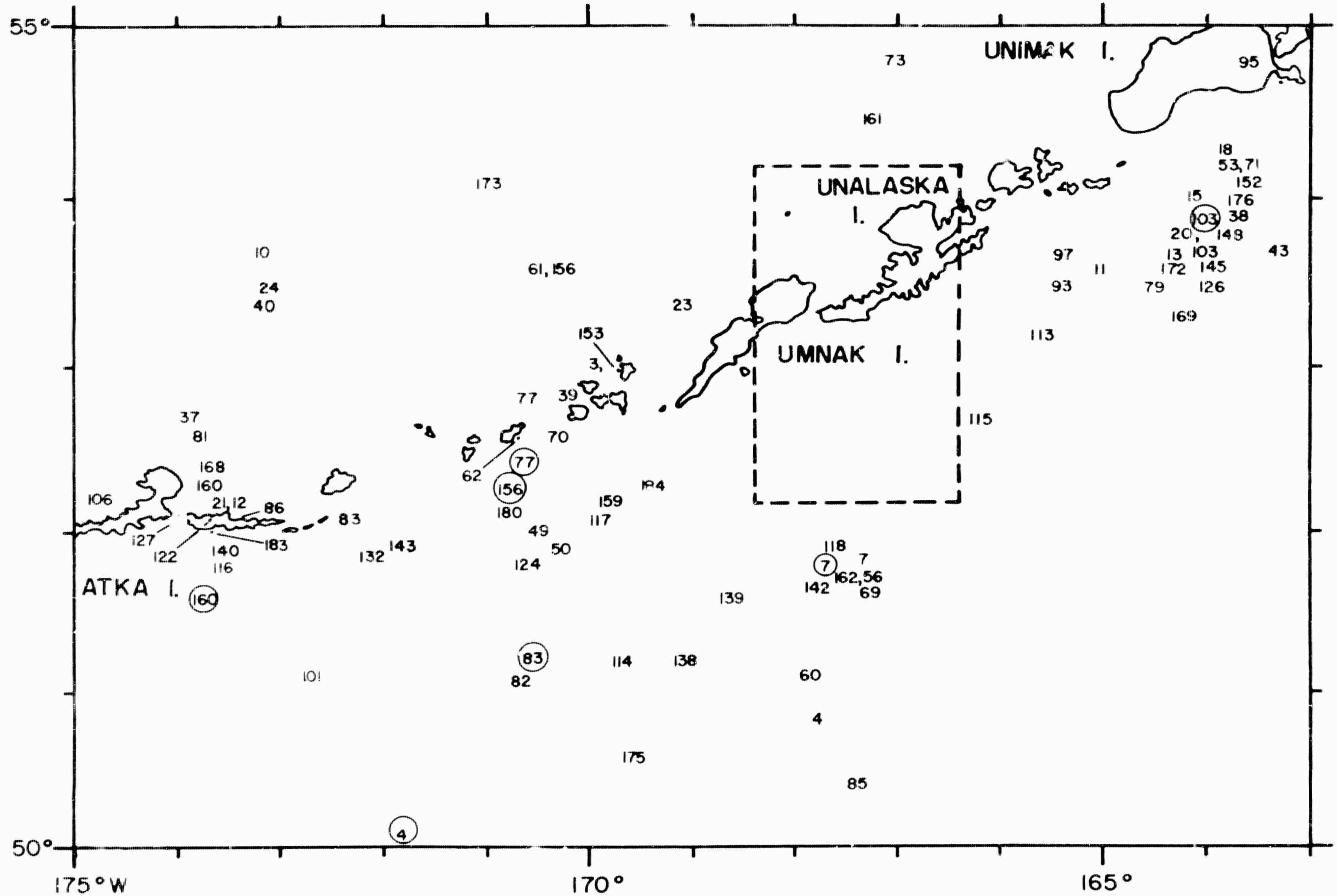

FIG. 2. *T*-phase source locations for the Aleutians between longitudes 163 W and 175 W. Numbers correspond to serial numbers in column 1 of Table I. Circled numbers are corresponding earthquake epicenters from Table IV. Unalaska Island area is shown in Figure 3.

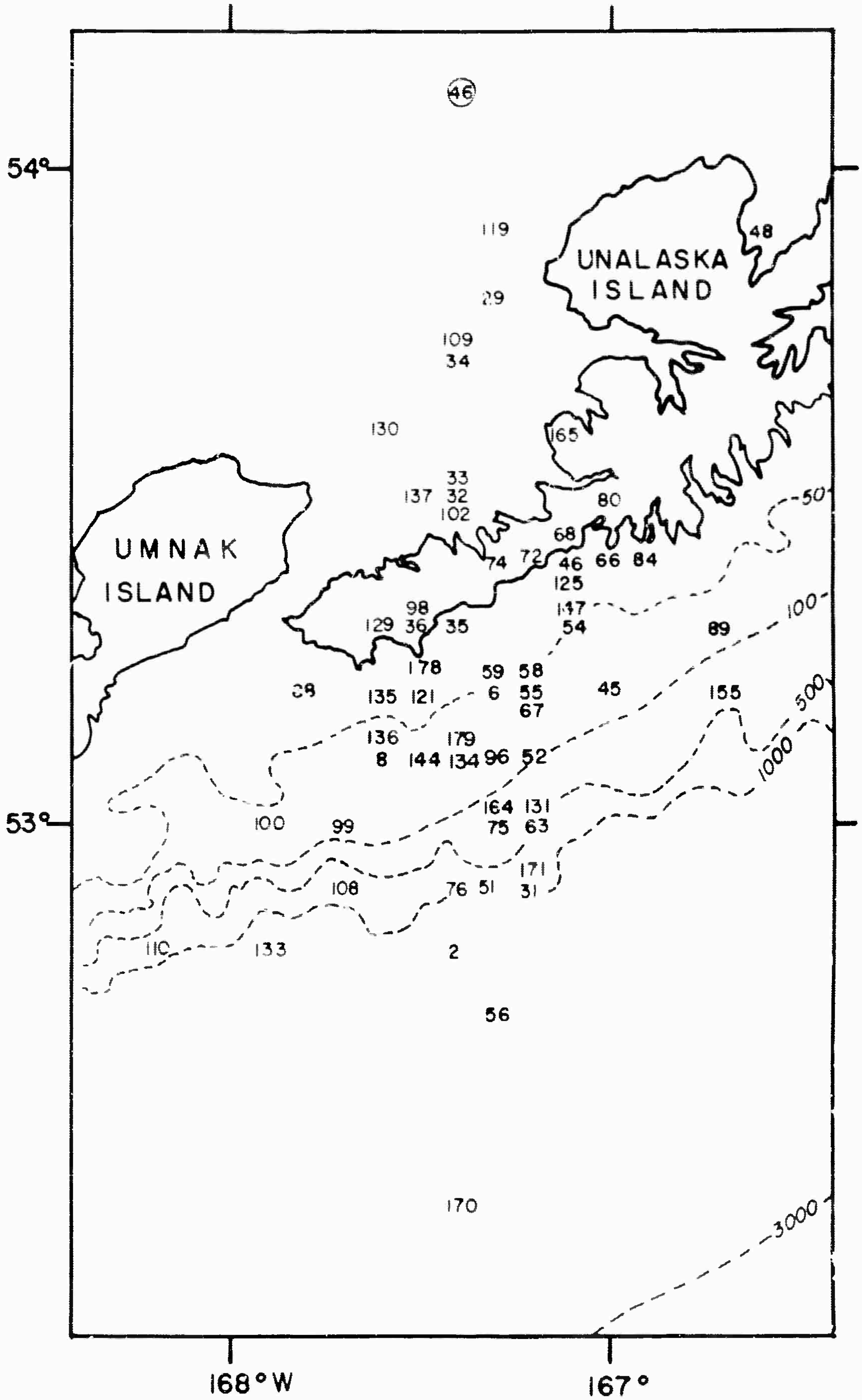

FIG. 3. *T*-phase source locations for the Unalaska Island area. Numbers correspond to serial numbers in column 1 of Table I. Circled number 46 marks the epicenter for the earthquake corresponding to *T*-phase source 46. Numbers in italics are contour depths in fathoms.

deviation of 0.53°. The location of the mean is about 0.3° inshore from the zone in which T-phase generation is assumed to take place.

Eight shots in the Aleutian series, ranging in weight from 2,200 to 6,800 pounds, were fired on land. T-phases were detected from none of these.

Twelve events reported by the Coast and Geodetic Survey appear to correlate with T-phase sources. These are listed in Table IV, and the corresponding events are indicated by asterisks in Table I. Figure 4 contains a plot of magnitude (as published on the USC&GS Preliminary Determination of Epicenter Cards) versus T-phase strength for 11 of these events and also a histogram of T-phase strength. As magnitude is a logarithmic scale of an amplitude measurement and T-phase strength is a logarithmic scale of power, one might expect a slope of 20 db per order of magnitude for a line relating the two. As might be expected, the scatter in the present data is great and the line drawn in the figure is intended only as a rough estimate. The histogram suggests a threshold for location at a T-phase strength about 20 db. It is further suggested that this corresponds to an earthquake magnitude 3.

SOFAR Location of Air Drops

As a check on the program, fixes were obtained for 21 explosions from air drops in the Aleutian shot series. The results are listed in Table III and can be compared with the times and locations reported by the aircraft (Gray and Tocher, 1964). The mean deviation between computed and reported origin times is 8 seconds which corresponds to about 12 kilometers or 0.1 degree of great circle. Individual deviations were as high as 30 seconds (shot 79).

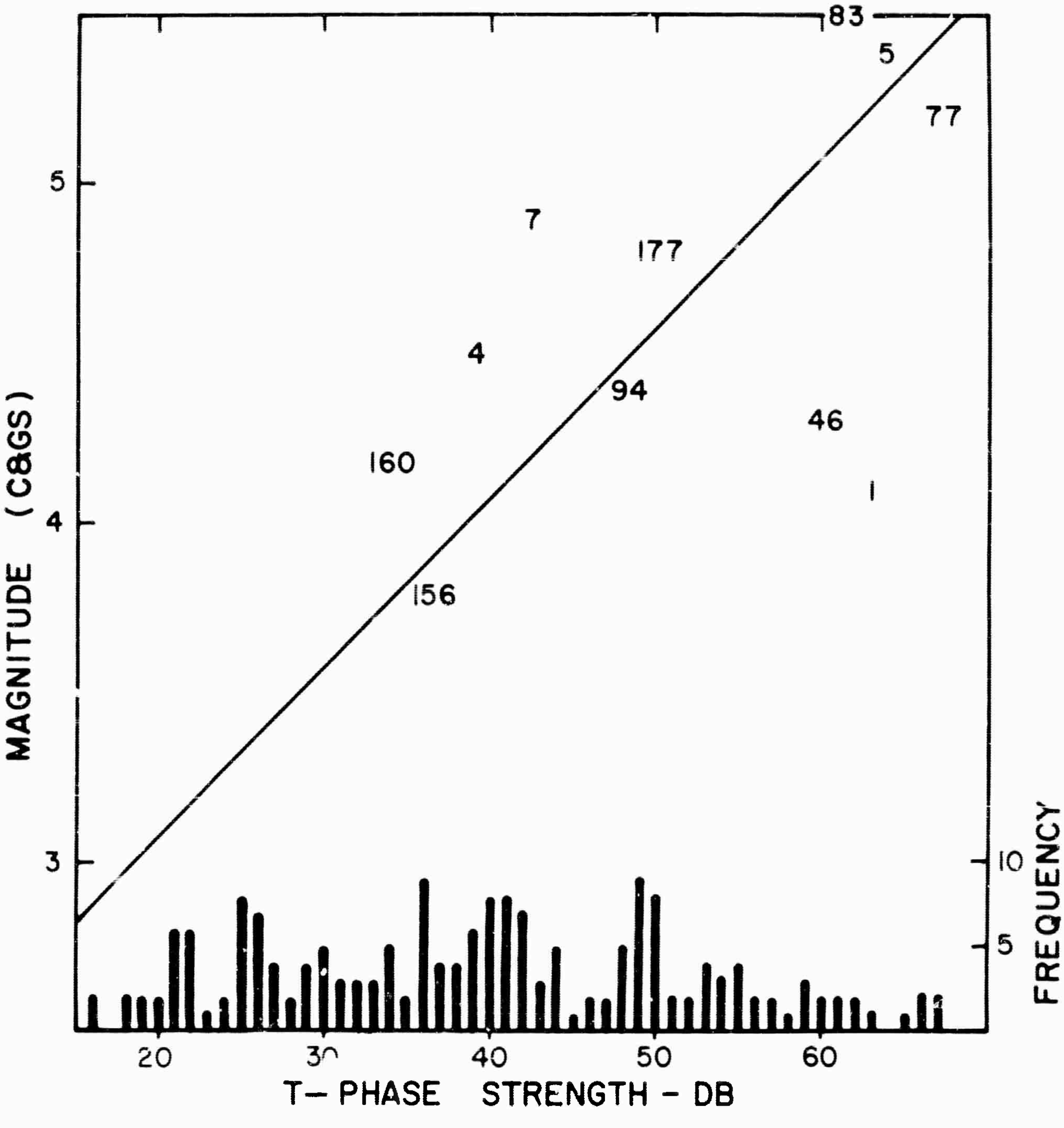

FIG. 4 Histogram of strengths of T-phase sources in the Aleutian area and C&GS magnitude versus T-phase strength for Aleutian events listed by the Coast & Geodetic Survey. Plotted numbers are from column 1 of Table I.

Acknowledgments

All staff members of the T-phase project, John Northrop, Roger Norris, James Sasser, and Norman Chang, contributed to this report through many hours of correlation of T phases from the charts. The computer program was principally written by William Butzlaff and James Sasser. Original data was supplied by the Pacific Missile Range. This research was supported by the Advanced Research Projects Agency under Office of Naval Research contract Nonr-3748(01).

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Explanation of Tables I, II, III

Column 1.	SER	In Tables I and II this is a serial number assigned chronologically. In Table III it is the serial number listed by Gray and Tocher (1964). An asterisk to the left of the serial number indicates that the event is also listed in the Preliminary Determination of Epicenter Cards by the Coast and Geodetic Survey.
Columns 2 to 6.	MDHMS	Greenwich mean origin time.
Colums 7 and 8.	LAT LONG	Geographic coordinates of T-phase source.
Column 9.	AREA	This name is for the region used in indexing velocities. It is not always descriptive of the location in columns 7 and 8.
Column 10.	SD	Standard deviation of origin times.
Column 11.	NO	Number of hydrophones from which arrival times were read.
Column 12.	DB	Maximum T-phase strength relative to 0.1 microbar at 30° from source.

TABLE I / PAGE 1

EARTHQUAKES LOCATED BY T PHASE 15 AUG TO 21 SEP 1964
ALEUTIAN ISLANDS

	SER	M	D	H	M	S	LAT		LONG		AREA	SD	NO	DB
*	1	AUG	15	2	28	13	52.5	N	179.4	W	EAST ALEUTIANS	5.3	11	63
	2	AUG	15	2	55	24	52.8	N	167.4	W	EAST ALEUTIANS	4.8	9	47
	3	AUG	17	9	25	37	53.0	N	169.9	W	EAST ALEUTIANS	5.1	11	54
*	4	AUG	17	12	43	13	50.8	N	167.8	W	EAST ALEUTIANS	5.3	9	39
*	5	AUG	17	16	38	36	51.8	N	179.1	E	WEST ALEUTIANS	6.0	11	64
	6	AUG	17	20	53	20	53.2	N	167.3	W	EAST ALEUTIANS	5.4	11	48
*	7	AUG	17	21	41	23	51.8	N	167.3	W	EAST ALEUTIANS	2.9	11	42
	8	AUG	18	10	10	22	53.1	N	167.6	W	EAST ALEUTIANS	1.8	10	56
	9	AUG	18	13	45		52	N	172	W	EAST ALEUTIANS		8	41
	10	AUG	18	15	56	35	53.7	N	173.2	W	EAST ALEUTIANS	2.9	11	54
	11	AUG	19	1	58	11	53.6	N	165.0	W	EAST ALEUTIANS	2.9	7	39
	12	AUG	19	17	15	12	52.2	N	173.4	W	EAST ALEUTIANS	2.0	10	62
	13	AUG	20	2	18	0	53.7	N	164.3	W	EAST ALEUTIANS	1.4	10	54
	14	AUG	20	3	51	5	52.6	N	175.5	W	EAST ALEUTIANS	4.3	10	49
	15	AUG	20	4	14	35	54.0	N	164.1	W	EAST ALEUTIANS	1.3	11	59
	16	AUG	20	8	12	54	51.0	N	179.0	W	EAST ALEUTIANS	2.8	9	42
	17	AUG	20	9	59	7	55.4	N	166.5	W	EAST ALEUTIANS	7.5	7	44
	18	AUG	20	22	25	51	54.3	N	163.8	W	EAST ALEUTIANS	1.1	6	43
	19	AUG	21	0	19		53	N	166	W	EAST ALEUTIANS		5	34
	20	AUG	21	8	4	39	53.8	N	164.2	W	EAST ALEUTIANS	1.0	8	36
	21	AUG	21	9	17	37	52.2	N	173.5	W	EAST ALEUTIANS	2.8	8	36
	22	AUG	21	13	27	32	51.0	N	178.2	W	EAST ALEUTIANS	4.7	9	49
	23	AUG	21	16	39	28	53.4	N	169.1	W	EAST ALEUTIANS	3.1	7	43
	24	AUG	21	19	47	2	53.5	N	173.1	W	EAST ALEUTIANS	0.9	6	33
	25	AUG	21	22	35	45	51.3	N	179.8	E	EAST ALEUTIANS	3.9	6	41
	26	AUG	22	1	22	52	52.7	N	178.4	W	EAST ALEUTIANS	2.0	6	55
	27	AUG	22	10	13	33	56.3	N	170.4	W	EAST ALEUTIANS	3.8	10	46
	28	AUG	22	15	55	57	51.0	N	177.3	W	EAST ALEUTIANS	2.2	8	56
	29	AUG	23	11	14	45	53.8	N	167.3	W	EAST ALEUTIANS	2.2	10	50
	30	AUG	23	12	20	57	52.0	N	176.9	W	EAST ALEUTIANS	3.0	9	52
	31	AUG	23	12	30	46	52.9	N	167.2	W	EAST ALEUTIANS	2.3	6	40
	32	AUG	23	15	41	39	53.5	N	167.4	W	EAST ALEUTIANS	1.4	9	59
	33	AUG	23	15	41	58	53.5	N	167.4	W	EAST ALEUTIANS	1.2	9	52
	34	AUG	23	15	42	6	53.7	N	167.4	W	EAST ALEUTIANS	1.9	9	55
	35	AUG	23	15	47	25	53.3	N	167.4	W	EAST ALEUTIANS	1.5	9	67
	36	AUG	23	15	49	10	53.3	N	167.5	W	EAST ALEUTIANS	1.0	7	51
	37	AUG	23	23	33	27	52.7	N	173.9	W	EAST ALEUTIANS	1.2	9	57
	38	AUG	24	1	7	34	53.9	N	163.8	W	EAST ALEUTIANS	1.2	9	49
	39	AUG	24	6	36	29	52.8	N	170.2	W	EAST ALEUTIANS	1.3	4	37
	40	AUG	24	9	32	25	53.4	N	173.2	W	EAST ALEUTIANS	1.3	7	65
	41	AUG	24	23	55	13	51.6	N	177.0	W	EAST ALEUTIANS	3.0	7	65
	42	AUG	25	10	59	24	52.0	N	176.9	W	EAST ALEUTIANS	2.9	7	39
	43	AUG	26	17	31	30	53.7	N	163.3	W	EAST ALEUTIANS	1.7	7	35
	44	AUG	26	17	50	59	51.7	N	176.7	W	EAST ALEUTIANS	1.3	8	49
	45	AUG	27	3	6	30	53.2	N	167.0	W	EAST ALEUTIANS	2.3	8	50

TABLE I / PAGE 2

SER	M	D	H	M	S	LAT	LONG	AREA	SD	NO	DB
* 46	AUG	27	3	10	4	53.4 N	167.1 W	EAST ALEUTIANS	3.3	11	60
47	AUG	27	4	58		53 N	165 W	EAST ALEUTIANS		4	61
48	AUG	27	5	28	26	53.9 N	166.6 W	EAST ALEUTIANS	5.3	7	44
49	AUG	28	0	10	50	52.0 N	170.5 W	EAST ALEUTIANS	4.3	7	32
50	AUG	28	0	14	38	51.9 N	170.3 W	EAST ALEUTIANS	5.9	8	33
51	AUG	28	1	24	9	52.9 N	167.3 W	EAST ALEUTIANS	1.4	7	40
52	AUG	28	17	39	32	53.1 N	167.2 W	EAST ALEUTIANS	1.0	5	39
53	AUG	28	20	40	38	54.3 N	163.8 W	EAST ALEUTIANS	2.2	10	40
54	AUG	28	21	17	38	53.3 N	167.1 W	EAST ALEUTIANS	1.7	8	40
55	AUG	29	3	36	60	53.2 N	167.2 W	EAST ALEUTIANS	2.8	10	50
56	AUG	29	4	5	55	51.7 N	167.3 W	EAST ALEUTIANS	0.2	5	37
57	AUG	29	5	11	40	49.3 N	167.4 W	EAST ALEUTIANS	0.9	5	36
58	AUG	29	5	16	48	53.2 N	167.2 W	EAST ALEUTIANS	1.9	10	49
59	AUG	29	5	18	13	5[illegible].2 N	167.3 W	EAST ALEUTIANS	1.4	8	40
60	AUG	29	15	48	27	51.1 N	167.9 W	EAST ALEUTIANS	6.2	8	39
61	AUG	29	18	36	26	53.6 N	170.5 W	EAST ALEUTIANS	1.5	11	48
62	AUG	29	20	42	43	52.6 N	170.7 W	EAST ALEUTIANS	1.4	10	41
63	AUG	29	20	51	40	53.0 N	167.2 W	EAST ALEUTIANS	0.7	6	41
64	AUG	30	2	1	2	51.3 N	179.4 E	WEST ALEUTIANS	0.6	7	41
65	AUG	30	8	11	12	49.7 N	175.9 E	WEST ALEUTIANS	14.9	9	50
66	AUG	30	20	40	59	53.4 N	167.0 W	EAST ALEUTIANS	3.7	6	42
67	AUG	30	20	42	29	53.2 N	167.2 W	EAST ALEUTIANS	2.0	6	41
68	AUG	30	20	44	34	53.4 N	167.1 W	EAST ALEUTIANS	1.2	6	41
69	AUG	30	21	48	25	51.6 N	167.3 W	EAST ALEUTIANS	0.1	5	57
70	AUG	31	4	51	58	52.6 N	170.3 W	EAST ALEUTIANS	1.2	8	49
71	AUG	31	6	19	12	54.2 N	163.7 W	EAST ALEUTIANS	1.3	8	40
72	AUG	31	14	32	56	53.4 N	167.2 W	EAST ALEUTIANS	1.0	11	50
73	AUG	31	15	48	40	54.8 N	167.0 W	EAST ALEUTIANS	1.4	6	52
74	AUG	31	16	5	2	53.4 N	167.3 W	EAST ALEUTIANS	2.0	11	53
75	AUG	31	16	6	49	53.0 N	167.3 W	EAST ALEUTIANS	1.4	6	39
76	AUG	31	16	8	10	52.9 N	167.4 W	EAST ALEUTIANS	3.0	7	46
* 77	AUG	31	23	19	51	52.8 N	170.6 W	EAST ALEUTIANS	2.0	11	67
78	SEP	1	0	32	37	51.4 N	175.9 E	WEST ALEUTIANS	2.2	11	62
79	SEP	1	8	25		53.5 N	164.5 W	EAST ALEUTIANS	2.9	9	38
80	SEP	1	14	2	46	53.5 N	167.0 W	EAST ALEUTIANS	2.1	10	49
81	SEP	1	15	47	2	52.6 N	173.8 W	EAST ALEUTIANS	3.0	10	66
82	SEP	1	17	16	56	51.1 N	170.7 W	EAST ALEUTIANS	3.3	7	41
* 83	SEP	1	17	17	13	52.1 N	172.4 W	EAST ALEUTIANS	3.8	11	61
84	SEP	2	1	55	20	53.4 N	166.9 W	EAST ALEUTIANS	4.3	7	42
85	SEP	2	4	5	26	50.4 N	167.4 W	EAST ALEUTIANS	0.6	5	33
86	SEP	2	15	31	50	52.1 N	173.4 W	EAST ALEUTIANS	1.4	6	39
87	SEP	2	16	13	21	56.0 N	166.1 W	EAST ALEUTIANS	3.1	8	44
88	SEP	3	6	47	35	53.2 N	167.8 W	EAST ALEUTIANS	2.2	8	40
89	SEP	3	9	33	46	53.3 N	166.7 W	EAST ALEUTIANS	2.2	7	44
90	SEP	3	10	52	35	51.4 N	173.7 E	WEST ALEUTIANS	3.7	11	50
91	SEP	3	11	15	54	55.4 N	166.7 W	EAST ALEUTIANS	1.6	9	53
92	SEP	3	12	35	41	51.9 N	176.9 W	EAST ALEUTIANS	1.9	11	59
93	SEP	4	17	14	22	53.5 N	165.4 W	EAST ALEUTIANS	1.8	11	47

TABLE I / PAGE 3

SER	M	D	H	M	S	LAT		LONG		AREA	SD	NO	DB
* 94	SEP	4	18	39	24	50.9	N	177.0	E	WEST ALEUTIANS	1.6	9	48
95	SEP	5	10	5	20	54.8	N	163.6	W	EAST ALEUTIANS	1.4	7	25
96	SEP	5	13	10	15	53.1	N	167.3	W	EAST ALEUTIANS	1.1	6	26
97	SEP	5	17	34	58	53.7	N	165.4	W	EAST ALEUTIANS	1.3	8	53
98	SEP	5	22	21	4	53.3	N	167.5	W	EAST ALEUTIANS	1.0	9	53
99	SEP	6	0	10	39	53.0	N	167.7	W	EAST ALEUTIANS	2.2	8	51
100	SEP	6	0	52	27	53.0	N	167.9	W	EAST ALEUTIANS	4.3	8	45
101	SEP	6	2	35	11	51.1	N	172.7	W	EAST ALEUTIANS	1.1	7	44
102	SEP	6	5	2	50	53.5	N	167.4	W	EAST ALEUTIANS	0.7	6	40
*103	SEP	6	10	30	8	53.7	N	164.0	W	EAST ALEUTIANS	2.5	10	34
104	SEP	6	18	41	14	52.8	N	177.3	W	EAST ALEUTIANS	9.1	7	32
105	SEP	6	22	26	52	53.4	N	175.2	W	EAST ALEUTIANS	0.8	5	26
106	SEP	7	1	39	11	52.3	N	174.3	W	EAST ALEUTIANS	0.8	8	43
107	SEP	7	9	11		51	N	178	E	WEST ALEUTIANS		5	25
108	SEP	7	15	0	23	52.9	N	167.7	W	EAST ALEUTIANS	0.6	5	22
109	SEP	7	15	14	6	53.7	N	167.4	W	EAST ALEUTIANS	1.2	8	42
110	SEP	7	16	16	44	52.8	N	168.2	W	EAST ALEUTIANS	0.5	5	30
111	SEP	7	23	26	21	52.0	N	176.6	W	EAST ALEUTIANS	0.9	6	43
112	SEP	8	6	30	54	52.4	N	175.2	W	EAST ALEUTIANS	2.3	8	55
113	SEP	8	11	25	43	53.2	N	165.6	W	EAST ALEUTIANS	3.1	9	49
114	SEP	8	14	26	35	51.2	N	169.7	E	WEST ALEUTIANS	0.4	5	38
115	SEP	8	14	43	40	52.7	N	166.2	W	EAST ALEUTIANS	3.1	11	55
116	SEP	8	21	22	36	51.8	N	173.6	W	EAST ALEUTIANS	1.5	9	24
117	SEP	9	7	2	38	52.1	N	169.9	W	EAST ALEUTIANS	2.4	9	31
118	SEP	9	10	41	54	51.9	N	167.6	W	EAST ALEUTIANS	2.2	9	30
119	SEP	9	13	30	47	53.9	N	167.3	W	EAST ALEUTIANS	1.5	11	38
120	SEP	9	13	56		52	N	168	W	EAST ALEUTIANS		5	18
121	SEP	9	16	50	18	53.2	N	167.5	W	EAST ALEUTIANS	1.3	10	30
122	SEP	9	21	34	53	52.1	N	173.6	W	EAST ALEUTIANS	1.9	11	31
123	SEP	9	21	48	57	51.7	N	176.4	W	EAST ALEUTIANS	3.1	8	26
124	SEP	9	22	20	59	51.8	N	170.6	W	EAST ALEUTIANS	0.6	5	27
125	SEP	10	3	46	18	53.4	N	167.1	W	EAST ALEUTIANS	5.5	8	30
126	SEP	10	6	47	10	53.5	N	164.0	W	EAST ALEUTIANS	1.4	10	21
127	SEP	10	10	55	58	52.1	N	174.0	W	EAST ALEUTIANS	5.1	8	25
128	SEP	10	11	25	57	54.3	N	174.8	E	WEST ALEUTIANS	3.0	7	24
129	SEP	10	16	24	19	53.3	N	167.6	W	EAST ALEUTIANS	1.4	11	41
130	SEP	10	16	37	42	53.6	N	167.6	W	EAST ALEUTIANS	1.6	7	21
131	SEP	10	16	56	9	53.0	N	167.2	W	EAST ALEUTIANS	1.0	7	22
132	SEP	10	19	7	58	51.9	N	172.1	W	EAST ALEUTIANS	6.6	9	25
133	SEP	11	3	50	16	52.8	N	167.9	W	EAST ALEUTIANS	5.6	6	26
134	SEP	11	7	8	14	53.1	N	167.4	W	EAST ALEUTIANS	0.5	6	21
135	SEP	11	11	16	32	53.2	N	167.6	W	EAST ALEUTIANS	2.3	9	29
136	SEP	11	11	26	54	53.1	N	167.6	W	EAST ALEUTIANS	1.7	9	33
137	SEP	11	11	40	22	53.5	N	167.5	W	EAST ALEUTIANS	0.7	6	19
138	SEP	11	14	40	45	51.2	N	169.1	W	EAST ALEUTIANS	1.8	7	30
139	SEP	11	14	43	39	51.6	N	168.6	W	EAST ALEUTIANS	10.2	5	21
140	SEP	11	18	35	23	51.9	N	173.6	W	EAST ALEUTIANS	1.3	9	22
141	SEP	12	6	20	51	51.2	N	176.4	E	WEST ALEUTIANS	1.3	7	21

SER	M	D	H	M	S	LAT		LONG		AREA	SD	NO	DB
142	SEP	12	9	54	11	51.7	N	167.8	W	EAST ALEUTIANS	0.1	5	16
143	SEP	12	11	40	24	51.9	N	171.9	W	EAST ALEUTIANS	1.3	8	19
144	SEP	12	18	20	50	53.1	N	167.5	W	EAST ALEUTIANS	1.3	7	23
145	SEP	12	22	37	52	53.7	N	164.0	W	EAST ALEUTIANS	2.0	7	26
146	SEP	13	0	14	48	51.2	N	178.4	W	EAST ALEUTIANS	0.9	7	37
147	SEP	13	1	38	28	53.3	N	167.1	W	EAST ALEUTIANS	1.7	8	26
148	SEP	13	3	29	21	53.8	N	164.0	W	EAST ALEUTIANS	2.0	9	31
149	SEP	13	4	12	12	51.1	N	179.3	E	WEST ALEUTIANS	1.2	8	36
150	SEP	13	16	40	57	50.7	N	177.4	E	WEST ALEUTIANS	1.1	7	20
151	SEP	13	21	18	58	51.5	N	176.0	E	WEST ALEUTIANS	2.2	8	25
152	SEP	13	23	57	25	54.2	N	163.6	W	EAST ALEUTIANS	2.6	8	28
153	SEP	14	2	18	46	53.0	N	169.7	W	EAST ALEUTIANS	1.0	7	23
154	SEP	14	7	26	26	51.4	N	178.3	W	EAST ALEUTIANS	2.0	7	25
155	SEP	14	9	5	46	53.2	N	166.7	W	EAST ALEUTIANS	2.0	8	29
*156	SEP	14	11	34	34	53.6	N	170.3	W	EAST ALEUTIANS	1.6	11	36
157	SEP	14	12	30	7	52.6	N	177.0	W	EAST ALEUTIANS	1.9	7	25
158	SEP	15	3	23	30	50.8	N	178.9	W	EAST ALEUTIANS	1.2	7	27
159	SEP	15	16	11	35	52.2	N	169.8	W	EAST ALEUTIANS	3.3	9	27
*160	SEP	16	3	32	23	52.3	N	173.7	W	EAST ALEUTIANS	5.3	10	34
161	SEP	16	10	50	23	54.5	N	167.2	W	EAST ALEUTIANS	0.2	4	29
162	SEP	16	10	53	1	51.7	N	167.5	W	EAST ALEUTIANS	0.1	4	25
163	SEP	16	11	10	20	55.2	N	171.0	W	EAST ALEUTIANS	1.2	5	22
164	SEP	16	11	35	1	53.0	N	167.3	W	EAST ALEUTIANS	2.3	9	35
165	SEP	16	11	39	41	53.6	N	167.1	W	EAST ALEUTIANS	3.3	8	36
166	SEP	16	13	10	26	48.4	N	167.4	W	EAST ALEUTIANS	1.0	5	20
167	SEP	16	18	39	43	52.3	N	177.0	W	EAST ALEUTIANS	1.9	9	34
168	SEP	16	19	36	42	52.4	N	173.7	W	EAST ALEUTIANS	2.6	7	20
169	SEP	16	20	14	8	53.3	N	164.2	W	EAST ALEUTIANS	3.2	9	32
170	SEP	16	20	57	34	52.4	N	167	W	EAST ALEUTIANS	3.5	7	22
171	SEP	16	21	13	6	52.9	N	167.2	W	EAST ALEUTIANS	1.8	7	29
172	SEP	16	22	24	28	53.7	N	164.2	W	EAST ALEUTIANS	1.7	11	42
173	SEP	17	1	11	14	54.1	N	171.0	W	EAST ALEUTIANS	0.1	4	16
174	SEP	17	18	57	52	51.7	N	178.9	W	EAST ALEUTIANS	3.2	7	27
175	SEP	17	22	28	58	50.6	N	169.6	W	EAST ALEUTIANS	4.0	5	19
176	SEP	18	7	20	35	53.9	N	163.7	W	EAST ALEUTIANS	2.5	13	60
*177	SEP	18	12	21	59	51.6	N	180.0	W	EAST ALEUTIANS	4.6	11	50
178	SEP	18	17	15	18	53.3	N	167.5	W	EAST ALEUTIANS	1.7	11	37
179	SEP	19	9	57	11	53.1	N	167.4	W	EAST ALEUTIANS	1.4	9	29
180	SEP	20	7	27	37	52.2	N	170.8	W	EAST ALEUTIANS	5.0	10	44
181	SEP	20	13	42	37	52.2	N	178.4	W	EAST ALEUTIANS	1.3	9	[illegible]
182	SEP	20	18	50	50	51.1	N	178.8	W	EAST ALEUTIANS	1.2	6	[illegible]
183	SEP	21	8	43	32	52.5	N	173.7	W	EAST ALEUTIANS	10.1	11	35
184	SEP	21	15	1	24	52.3	N	169.4	W	EAST ALEUTIANS	1.7	6	21

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EARTHQUAKES LOCATED BY T PHASE 15 AUG TO 21 SEP 1964
PACIFIC OCEAN EXCEPT ALEUTIANS

SER	M	D	H	M	S	LAT		LONG		AREA	SD	NO	DB
1	AUG	15	1	16	36	1.8	N	82.0	W	ECUADOR	2.0	7	58
2	AUG	15	1	57	52	23.0	N	121.9	E	TAIWAN	0.4	7	54
3	AUG	15	9	44		56	N	163	E	KAMCHATKA		9	47
4	AUG	15	9	52	6	53.8	N	164.5	E	KOMANDORSKIS	2.2	7	38
5	AUG	15	20	58		49	N	155	E	KURILS		10	50
6	AUG	15	23	1	49	56.6	N	164.8	E	KOMANDORSKIS	3.1	10	41
7	AUG	16	0	47	40	47.1	N	152.1	E	KURILS	1.4	10	51
8	AUG	16	2	45	12	4[illegible].1	N	150.3	E	KURILS	6.3	10	44
9	AUG	16	7	48	5[illegible]	44.7	N	155.3	E	KURILS	4.6	6	34
10	AUG	16	10	3	28	45.6	N	153.5	E	KURILS	0.5	4	32
* 11	AUG	16	11	41		40	N	142	E	JAPAN		9	66
12	AUG	16	12	42	15	56.2	N	152.8	W	KODIAK ISLAND	0.9	6	46
13	AUG	16	14	32	5	38.3	N	142.8	E	JAPAN	2.5	5	44
14	AUG	16	15	33	7	54.9	N	164.1	E	KOMANDORSKIS	1.4	7	37
15	AUG	16	17	8	40	45.5	N	152.0	E	KURILS	10.5	8	38
* 16	AUG	16	20	34	34	54.2	N	172.1	E	KOMANDORSKIS	3.1	11	69
17	AUG	16	23	58	20	46.8	N	152.0	E	KURILS	3.4	10	52
18	AUG	17	3	2		45	N	148	E	HOKKAIDO		9	46
19	AUG	17	3	35		38	N	142	E	JAPAN		5	48
20	AUG	17	4	25	30	10.4	S	176.8	W	SAM A	2.9	6	52
21	AUG	17	5	41	37	46.5	N	152.4	E	KURILS	4.4	8	37
22	AUG	17	5	19		50	N	156	E	KURILS		10	41
* 23	AUG	17	11	52		47	N	152	E	KURILS		10	65
* 24	AUG	17	14	54	39	41.9	N	143.7	E	HOKKAIDO	6.0	10	67
25	AUG	17	14	56		42	N	143	E	HOKKAIDO		8	60
26	AUG	17	22	53	27	40.1	N	128.3	W	SAN ANDREAS EXT	0.9	5	41
27	AUG	18	3	58	49	54.7	N	151.8	E	KAMCHATKA	2.0	10	49
* 28	AUG	18	4	36	50	42.5	N	146.5	E	HOKKAIDO	2.0	8	46
* 29	AUG	18	4	45		25	S	71	W	BAJA CALIFORNIA		7	54
30	AUG	18	6	20	27	54.9	N	161.2	E	KAMCHATKA	3.4	11	72
31	AUG	18	7	30	34	5.3	N	83.1	W	ECUADOR	1.3	8	52
32	AUG	18	15	2		15	S	77	W	PERU		8	61
33	AUG	18	15	43		56	N	163	E	KOMANDORSKIS		5	47
34	AUG	18	19	24	24	52.9	N	171.0	E	KOMANDORSKIS	1.9	9	49
35	AUG	18	22	12		49	N	155	E	KURILS		9	53
36	AUG	18	23	54	1	8.2	S	160.1	E	SOLOMONS	0.9	4	39
37	AUG	19	2	9	27	45.2	N	148.5	E	HOKKAIDO	1.6	5	41
38	AUG	19	3	4	15	51.8	N	128.3	W	CALIFORNIA	1.5	5	42
39	AUG	19	3	50	58	53.3	N	162.8	W	KODIAK ISLAND	3.9	8	44
40	AUG	19	4	50	9	28.6	S	107.8	W	SOUTH PACIFIC	0.6	5	57
41	AUG	19	5	23	26	41.2	N	130.3	W	SAN ANDREAS EXT	0.6	6	45
42	AUG	19	9	48	15	46.6	N	152.0	E	KURILS	2.9	8	38
43	AUG	19	11	40		46	N	124	W	SAN ANDREAS EXT		10	63
44	AUG	19	11	54	28	54.2	N	165.3	E	KOMANDORSKIS	3.3	8	56
45	AUG	19	14	40	56	39.0	N	140.5	E	JAPAN	1.4	6	44

	SER	M	D	H	M	S	LAT		LONG		AREA	SD	NO	DB
	46	AUG	19	14	51		19	N	156	W	HAWAII		6	43
	47	AUG	19	18	59	53	9.9	N	143.6	E	MARIANAS	0.8	7	51
	48	AUG	19	20	5	54	38.4	N	144.0	E	JAPAN	1.8	6	55
	49	AUG	19	20	10	25	12.5	N	148.7	E	MARIANAS	0.8	5	35
	50	AUG	20	2	21	56	49.2	N	154.0	E	KURILS	3.6	7	40
	51	AUG	20	4	49	29	56.3	N	153.2	W	KODIAK ISLAND	1.9	7	45
	52	AUG	20	19	2	13	55.1	N	160.5	E	KAMCHATKA	1.1	5	41
	53	AUG	20	19	25	47	44.2	N	131.1	W	SAN ANDREAS EXT	2.9	7	51
	54	AUG	21	2	3	44	47.5	N	151.0	E	KURILS	4.3	10	43
	55	AUG	21	4	16	51	54.2	N	162.1	E	KAMCHATKA	0.8	5	35
	56	AUG	21	4	30		50	N	156	E	KURILS		9	39
	57	AUG	21	4	48	49	45.1	N	147.9	E	HOKKAIDO	2.1	9	44
	58	AUG	21	9	25	8	55.2	N	159.0	W	KODIAK ISLAND	1.0	10	44
*	59	AUG	21	10	9	39	19.6	S	65.9	W	PERU	9.9	6	68
	60	AUG	21	10	41		58	N	137	W	QUEEN CHARLOTTE		10	50
	61	AUG	21	11	26		5	S	87	W	GALAPAGOS		7	52
	62	AUG	21	11	28	43	45.7	N	149.0	E	HOKKAIDO	2.6	7	45
	63	AUG	21	11	48	60	55.0	N	158.2	W	KODIAK ISLAND	1.6	5	33
	64	AUG	21	13	20	3	46.1	N	149.3	E	HOKKAIDO	6.0	9	55
	65	AUG	21	15	55	11	49.1	N	153.8	E	KURILS	9.7	8	38
	66	AUG	22	0	17	36	53.6	N	158.8	E	KAMCHATKA	3.0	10	54
	67	AUG	22	1	56	34	54.6	N	161.6	E	KAMCHATKA	2.4	8	57
	68	AUG	22	2	1	41	52.7	N	159.1	E	KAMCHATKA	1.0	8	84
	69	AUG	22	2	39	59	52.0	N	157.0	E	KAMCHATKA	1.9	10	49
	70	AUG	22	4	12	15	52.9	N	158.3	E	KAMCHATKA	1.6	11	94
	71	AUG	22	6	54		51	N	157	E	KURILS		10	52
	72	AUG	22	8	7	47	46.1	N	152.7	E	KURILS	3.2	8	51
	73	AUG	22	17	10	46	48.6	N	149.7	E	KURILS	1.3	9	50
	74	AUG	22	18	40		53	N	160	E	KAMCHATKA		5	42
*	75	AUG	22	20	8	17	5.3	S	159.9	E	BISMARCK	11.4	6	55
	76	AUG	22	22	27		40	N	124	W	GUERRERO		10	59
	77	AUG	22	23	45		40	N	124	W	CALIFORNIA		10	62
	78	AUG	23	0	30	12	26.1	N	144.0	E	BONIN ISLANDS	1.4	7	60
	79	AUG	23	0	30	13	49.3	N	153.8	E	KURILS	4.0	10	52
	80	AUG	23	1	2	6	41.7	N	146.6	E	HOKKAIDO	2.2	8	50
	81	AUG	23	2	5		44	N	124	W	SAN ANDREAS EXT		6	54
	82	AUG	23	5	56	47	6.0	N	83.0	W	JALISCO	2.8	7	51
	83	AUG	23	7	37	20	35.6	N	140.7	E	JAPAN	0.5	6	45
	84	AUG	23	12	50	55	54.8	N	163.8	E	KAMCHATKA	1.2	7	55
	85	AUG	23	13	5	4	59.5	N	136.9	W	QUEEN CHARLOTTE	1.5	6	45
	86	AUG	23	16	9	59	4.7	N	94.8	W	GALAPAGOS	1.1	9	66
	87	AUG	24	6	56	11	50.7	N	163.6	E	KAMCHATKA	2.2	8	40
	88	AUG	24	9	50	6	42.6	N	141.0	E	HOKKAIDO	9.3	9	52
	89	AUG	24	16	43		2	N	79	W	ECUADOR		7	70
	90	AUG	24	17	54	15	45.2	N	148.5	E	HOKKAIDO	0.8	5	44
	91	AUG	24	20	32	28	53.4	N	153.6	E	KURILS	0.9	7	32
	92	AUG	24	22	15	37	55.4	N	158.6	E	KAMCHATKA	3.3	8	52
	93	AUG	25	0	1	48	46.4	N	149.2	E	HOKKAIDO	2.7	4	35

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SER	M	D	H	M	S	LAT		LONG		AREA	SD	NO	DB
94	AUG	25	1	59	17	41.9	N	143.4	W	SAN ANDREAS EXT	1.5	10	45
95	AUG	25	3	25	23	54.1	N	161.7	W	KODIAK ISLAND	1.7	7	35
96	AUG	25	10	7	47	46.4	N	149.2	E	HOKKAIDO	0.7	6	46
97	AUG	25	10	8	50	45.1	N	150.0	E	HOKKAIDO	2.2	7	34
98	AUG	25	12	7	3	54.1	N	130.9	W	VANCOUVER	1.6	11	68
99	AUG	25	12	28	18	58.8	N	150.3	W	KODIAK ISLAND	7.0	7	55
100	AUG	25	13	53	55	56.9	N	162.2	W	KODIAK ISLAND	2.1	8	41
101	AUG	25	15	10	47	56.5	N	149.8	W	KODIAK ISLAND	1.3	10	47
102	AUG	25	15	11	32	57.3	N	151.2	W	KODIAK ISLAND	1.4	7	56
103	AUG	25	19	36	22	58.7	N	141.0	W	QUEEN CHARLOTTE	3.0	9	47
104	AUG	25	19	37	35	57.2	N	143.2	W	QUEEN CHARLOTTE	7.8	6	39
105	AUG	25	22	52	53	43.4	N	145.3	E	HOKKAIDO	0.9	5	37
106	AUG	25	23	38	5	34.7	N	139.0	E	JAPAN	0.3	7	53
107	AUG	26	1	17	12	46.0	N	150.5	E	KURILS	3.3	9	48
108	AUG	26	1	17	30	46.4	N	150.3	E	KURILS	2.0	9	51
109	AUG	26	1	59	28	11.4	N	125.8	E	TAIWAN	1.6	6	38
110	AUG	26	3	20	15	54.8	N	161.0	E	KAMCHATKA	1.8	10	69
*111	AUG	26	5	33	46	50.7	N	145.1	E	KURILS	3.3	9	55
112	AUG	26	6	59	9	61.4	N	143.3	W	GULF OF ALASKA	1.8	5	47
*113	AUG	26	7	38		44	N	152	E	KURILS		6	40
114	AUG	26	17	3	50	17.7	N	125.3	E	TAIWAN	2.0	5	54
115	AUG	26	18	32		19	N	156	W	HAWAII		6	56
116	AUG	26	21	49	41	47.4	N	151.3	E	KURILS	4.8	9	58
117	AUG	27	0	20	47	31.2	N	155.8	E	BONIN ISLANDS	0.7	4	23
118	AUG	27	3	39	47	39.2	N	131.0	W	SAN ANDREAS EXT	1.3	7	51
119	AUG	27	5	37	4	8.5	S	175.8	W	SAMOA	4.5	5	40
120	AUG	27	14	6	55	44.9	N	123.8	W	SAN ANDREAS EXT	1.5	8	51
121	AUG	27	14	7	1	54.7	N	165.5	E	KOMANDORSKIS	0.7	8	38
122	AUG	27	20	36	16	57.0	N	149.0	W	KODIAK ISLAND	1.4	9	39
123	AUG	27	20	59	11	54.8	N	167.3	E	KOMANDORSKIS	2.6	8	43
*124	AUG	27	23	47	48	21.2	S	175.5	W	SAMOA	1.9	5	47
125	AUG	28	2	1	3	57.1	N	149.7	W	KODIAK ISLAND	1.6	10	62
126	AUG	28	5	57	19	44.9	N	150.0	E	HOKKAIDO	1.2	11	58
*127	AUG	28	12	18		23	N	122	E	TAIWAN		5	54
*128	AUG	28	19	6		23	N	122	E	TAIWAN		5	53
129	AUG	28	21	42	3	50.3	N	169.7	E	KOMANDORSKIS	3.5	7	42
130	AUG	28	22	31	52	47.5	N	151.0	E	KURILS	7.2	7	36
*131	AUG	28	22	57	55	51.3	N	130.7	W	VANCOUVER	2.2	9	60
132	AUG	29	0	35	43	13.8	S	77.8	W	PERU	1.5	7	53
133	AUG	29	0	38	3	11.8	S	176.6	W	SAMOA	1.8	6	41
134	AUG	29	2	19	48	8.3	S	172.5	E	SAMOA	1.4	4	45
135	AUG	29	3	40		2	S	78	W	PERU		6	[illegible]
136	AUG	29	6	2	5	11.8	S	112.6	W	GALAPAGOS	0.1	4	66
137	AUG	29	10	30	34	1.4	S	172.5	E	SAMOA	3.1	5	47
138	AUG	29	16	3	31	2.2	N	95.5	W	PERU	2.9	8	61
139	AUG	29	16	3	46	3.9	N	93.5	W	GALAPAGOS	2.1	6	54
140	AUG	29	16	3	54	1.3	N	93.1	W	GALAPAGOS	0.8	8	59
141	AUG	29	16	4	12	2.2	N	95.6	W	PERU	2.4	7	54

SER	M	D	H	M	S	LAT		LONG		AREA	SD	NO	DB
142	AUG	29	16	5	56	0.8	S	88.1	W	ECUADOR	3.4	9	67
143	AUG	29	16	9	15	1.8	S	85.8	W	ECUADOR	3.1	6	57
144	AUG	29	16	17	47	0.4	N	91.2	W	GALAPAGOS	2.7	9	67
145	AUG	29	16	20	57	2.1	N	95.2	W	GALAPAGOS	1.4	7	57
*146	AUG	29	17	24	57	3.8	N	100.7	W	GUERRERO	1.2	9	70
147	AUG	29	19	27	59	12.6	N	127.8	E	TAIWAN	2.3	7	62
148	AUG	29	20	9	7	8.9	S	170.6	E	BISMARCK	4.1	4	48
149	AUG	29	20	41	51	15.2	S	176.0	E	SAMOA	3.5	8	48
150	AUG	30	3	29	9	47.1	N	151.6	E	KURILS	3.6	11	53
151	AUG	30	3	39	52	45.9	N	144.9	E	HOKKAIDO	3.4	10	54
152	AUG	30	3	41		36	N	122	W	CALIFORNIA		8	61
153	AUG	30	4	35	58	22.1	S	172.0	E	SAMOA	0.5	5	60
154	AUG	30	5	10	59	42.1	N	142.7	E	HOKKAIDO	2.8	10	55
155	AUG	30	5	12	51	41.1	N	142.4	E	HOKKAIDO	3.4	9	49
156	AUG	30	9	6	28	46.9	N	149.3	E	KURILS	3.9	10	55
157	AUG	30	9	7	8	46.1	N	150.7	E	KURILS	3.6	9	50
158	AUG	30	12	35	39	55.3	N	165.6	E	KOMANDORSKIS	1.8	7	45
159	AUG	30	14	13	59	52.3	N	153.5	E	KURILS	6.4	10	44
160	AUG	30	14	15	57	51.4	N	154.9	E	KURILS	6.0	10	40
161	AUG	30	15	32	14	47.4	N	148.1	E	HOKKAIDO	1.9	6	41
162	AUG	30	20	16	10	16.3	S	73.5	W	PERU	2.1	7	63
163	AUG	30	20	57	19	6.9	N	172.5	E	BISMARCK	12.4	6	49
164	AUG	30	21	7	45	6.5	N	172.5	E	BISMARCK	8.2	7	58
165	AUG	31	2	18	46	50.6	N	156.3	E	KURILS	2.5	11	47
*166	AUG	31	2	41	24	55.3	N	161.1	E	KAMCHATKA	2.6	11	66
167	AUG	31	8	15	44	57.0	N	135.8	W	QUEEN CHARLOTTE	1.6	11	61
168	AUG	31	8	56	55	35.4	N	141.0	E	JAPAN	2.2	7	53
169	AUG	31	9	4	45	57.8	N	150.2	W	KODIAK ISLAND	0.2	5	55
170	AUG	31	9	33	24	57.0	N	149.0	W	GULF OF ALASKA	1.8	5	46
171	AUG	31	10	2	18	55.8	N	163.5	E	KAMCHATKA	0.9	9	43
172	AUG	31	10	6		53	N	171	E	KOMANDORSKIS		9	42
173	AUG	31	10	9	17	54.5	N	169.6	E	KOMANDORSKIS	0.8	9	50
174	AUG	31	10	51	24	51.3	N	157.2	E	KURILS	3.0	10	51
175	AUG	31	12	14	42	47.5	N	155.0	E	KURILS	4.0	11	51
176	AUG	31	12	16	11	47.5	N	155.0	E	KURILS	1.7	9	43
177	AUG	31	14	30	26	57.6	N	134.3	W	QUEEN CHARLOTTE	1.1	11	56
178	AUG	31	16	49	10	16.3	N	98.2	W	GUERRERO	0.6	5	67
179	AUG	31	17	13	12	50.4	N	156.6	E	KURILS	0.9	6	35
*180	AUG	31	19	37	29	58.4	N	145.8	W	GULF OF ALASKA	1.2	7	66
181	AUG	31	20	20	55	57.3	N	147.7	W	GULF OF ALASKA	1.3	5	41
182	AUG	31	23	46	32	15.1	S	172.6	E	SAMOA	1.5	4	55
183	SEP	1	0	10	60	13.3	S	172.6	E	SAMOA	1.0	4	56
184	SEP	1	3	1	53	13.8	S	172.6	E	SAMOA	0.2	4	52
185	SEP	1	4	55		54	N	161	E	KAMCHATKA		7	40
186	SEP	1	6	22	38	11.2	S	172.7	E	SAMOA	0.3	4	44
187	SEP	1	6	33	17	56.7	N	146.3	W	KODIAK ISLAND	1.1	8	36
188	SEP	1	7	18	16	24.4	S	172.3	E	SAMOA	1.4	4	55
189	SEP	1	9	25	6	20.3	N	126.1	E	TAIWAN	0.7	4	57

SER	M	D	H	M	S	LAT		LONG		AREA	SD	NO	DB
190	SEP	1	9	47	32	22.0	S	119.8	W	GALAPAGOS	2.0	5	55
191	SEP	1	11	33	23	3.6	N	80.4	W	ECUADOR	1.3	8	58
192	SEP	1	11	40	37	47.7	N	154.7	E	KURILS	1.7	5	34
193	SEP	1	15	45	2	16.3	S	171.4	W	SAMOA	1.0	4	49
194	SEP	1	15	45	56	15.1	S	171.9	W	SAMOA	1.9	4	40
195	SEP	1	16	56	6	17.8	N	149.8	E	MARIANAS	2.4	4	26
196	SEP	1	17	15	32	52.4	N	150.7	W	KODIAK ISLAND	1.1	8	47
197	SEP	1	17	56	16	46.8	N	152.1	E	KURILS	3.8	10	39
198	SEP	1	19	50		36	N	122	W	CALIFORNIA		9	50
199	SEP	1	22	33	26	36.7	N	121.7	W	CALIFORNIA	1.6	10	51
200	SEP	1	22	50	8	54.7	N	161.4	E	KAMCHATKA	2.5	11	67
201	SEP	2	1	58		36	N	122	W	CALIFORNIA		10	44
202	SEP	2	7	41	59	58.0	N	149.1	W	KODIAK ISLAND	1.8	5	37
203	SEP	2	11	2	5	39.4	N	141.8	E	JAPAN	0.2	4	41
204	SEP	2	12	8	3	6.0	N	97.9	W	GALAPAGOS	1.6	7	56
205	SEP	2	14	39	1	52.7	N	159.0	E	KAMCHATKA	3.0	11	45
206	SEP	2	18	40		2	N	80	W	ECUADOR		7	63
207	SEP	2	20	43	11	45.5	N	148.9	E	HOKKAIDO	1.2	9	42
208	SEP	3	4	1	26	52.2	N	158.6	E	KAMCHATKA	1.9	10	41
209	SEP	3	4	7	29	22.0	N	121.3	E	TAIWAN	1.0	7	47
210	SEP	3	5	32	27	49.9	N	131.9	W	VANCOUVER	1.1	11	61
211	SEP	3	6	5	2	50.2	N	131.2	W	VANCOUVER	3.2	10	36
212	SEP	3	7	27	22	49.8	N	132.1	W	VANCOUVER	2.6	11	52
213	SEP	3	9	31	19	55.4	N	153.2	W	KODIAK ISLAND	1.3	10	57
214	SEP	3	10	20	55	10.3	S	172.7	E	SAMOA	3.7	6	57
215	SEP	3	10	22	31	8.1	S	172.2	E	SAMOA	4.1	7	53
216	SEP	3	11	24		43	N	125	W	CALIFORNIA		7	48
*217	SEP	3	11	49		43	N	127	W	SAN ANDREAS EXT		11	71
218	SEP	3	13	42	38	56.3	N	147.1	W	KODIAK ISLAND	7.6	10	60
*219	SEP	3	17	3	22	11.9	S	175.2	W	SAMOA	6.3	7	54
220	SEP	3	22	59	49	55.3	N	153.5	W	KODIAK ISLAND	3.2	10	56
221	SEP	3	23	58	43	50.4	N	129.7	W	VANCOUVER	1.2	10	42
222	SEP	4	0	0	46	50.6	N	129.7	W	VANCOUVER	1.4	10	50
223	SEP	4	0	1		50	N	128	W	VANCOUVER		9	39
224	SEP	4	0	8	20	50.2	N	156.7	E	KURILS	2.2	11	44
*225	SEP	4	1	26		4	S	154	E	BISMARCK		4	35
226	SEP	4	2	52	22	46.9	N	148.9	E	HOKKAIDO	0.8	5	40
227	SEP	4	3	3	3	45.0	N	150.3	E	HOKKAIDO	0.8	6	35
*228	SEP	4	4	10	24	58.9	N	139.2	W	QUEEN CHARLOTTE	3.3	9	49
229	SEP	4	5	8		55	N	162	E	KAMCHATKA		8	54
230	SEP	4	5	51	33	45.6	N	143.3	E	HOKKAIDO	4.3	10	51
*231	SEP	4	8	13	54	51.5	N	159.6	E	KAMCHATKA	8.6	11	62
*232	SEP	4	9	44	21	17.9	S	75.8	W	PERU	3.4	9	57
233	SEP	4	12	57	54	21.8	N	118.3	E	TAIWAN	1.5	5	39
234	SEP	4	13	50	19	33.9	N	140.1	E	JAPAN	2.5	7	54
*235	SEP	4	17	11	2	5.6	N	95.9	W	GALAPAGOS	2.4	6	53
236	SEP	5	0	12	38	49.8	N	152.1	E	KURILS	4.5	6	61
237	SEP	5	2	50	49	15.5	S	105.5	W	GALAPAGOS	4.6	5	56

SER	M	D	H	M	S	LAT		LONG		AREA	SD	NO	DB
*238	SEP	5	2	58	28	2.9	S	157.7	E	BISMARCK	2.9	5	40
239	SEP	5	4	43	21	56.0	N	141.8	W	QUEEN CHARLOTTE	2.1	11	26
240	SEP	5	8	52	52	53.6	N	153.4	E	KURILS	5.3	10	33
241	SEP	5	14	10	57	58.5	N	158.7	E	KAMCHATKA	3.0	5	21
242	SEP	5	15	16	24	47.7	N	144.7	E	HOKKAIDO	1.9	6	28
243	SEP	5	16	7	20	54.8	N	154.0	W	KODIAK ISLAND	1.0	5	28
244	SEP	5	17	28	13	57.9	N	160.7	W	KODIAK ISLAND	2.2	6	47
245	SEP	5	19	37	57	35.3	N	141.7	E	JAPAN	0.3	5	22
246	SEP	5	23	15	21	49.7	N	128.4	W	VANCOUVER	1.5	11	57
247	SEP	6	4	18	5	55.5	N	163.7	E	KOMANDORSKIS	1.2	7	26
248	SEP	6	5	21	43	60.6	N	135.7	W	QUEEN CHARLOTTE	2.0	7	47
249	SEP	6	15	8	3	7.2	S	104.5	W	GALAPAGOS	1.6	4	38
250	SEP	6	15	16	27	6.0	S	107.4	W	GALAPAGOS	0.4	4	33
251	SEP	6	15	20	37	7.8	S	102.5	W	GALAPAGOS	0.2	4	43
252	SEP	6	15	27	43	7.7	S	102.1	W	GALAPAGOS	1.1	4	35
253	SEP	6	15	31	49	6.3	S	106.6	W	GALAPAGOS	0.2	4	35
254	SEP	6	15	37	57	6.0	S	107.4	W	GALAPAGOS	1.5	5	50
255	SEP	6	15	43	35	6.4	S	105.8	W	GALAPAGOS	0.8	4	45
256	SEP	6	16	5	50	5.6	S	108.9	W	GALAPAGOS	0.3	4	35
257	SEP	6	17	10	45	53.2	N	158.8	E	KAMCHATKA	2.2	8	45
258	SEP	6	18	54	36	53.2	N	170.8	E	KOMANDORSKIS	1.4	9	34
259	SEP	6	20	23	37	53.0	N	136.8	W	QUEEN CHARLOTTE	1.3	10	46
*260	SEP	6	21	9	18	4.9	S	109.8	W	PERU	2.3	9	65
261	SEP	6	21	10	11	7.7	S	103.0	W	GALAPAGOS	0.9	5	52
*262	SEP	6	21	19	52	5.5	S	108.6	W	GALAPAGOS	0.5	5	59
263	SEP	6	21	59	39	6.8	S	105.7	W	GALAPAGOS	0.1	4	45
264	SEP	6	22	3	15	7.4	S	103.7	W	GALAPAGOS	0.4	4	35
265	SEP	6	23	21	10	8.8	S	100.1	W	GALAPAGOS	0.9	4	45
266	SEP	6	23	35	11	5.6	S	108.1	W	GALAPAGOS	0.4	4	43
267	SEP	7	0	20	11	7.3	S	103.8	W	GALAPAGOS	0.3	4	52
268	SEP	7	1	27	32	17.8	N	124.4	E	TAIWAN	3.4	4	42
269	SEP	7	1	29	60	7.0	S	104.8	W	GALAPAGOS	1.1	4	41
270	SEP	7	2	4	36	46.2	N	144.5	E	HOKKAIDO	0.8	5	33
271	SEP	7	2	8	26	7.4	S	103.8	W	GALAPAGOS	1.3	4	34
272	SEP	7	2	21	33	6.8	S	105.2	W	GALAPAGOS	0.4	4	36
*273	SEP	7	3	40	46	20.2	N	123.4	E	TAIWAN	1.1	7	59
*274	SEP	7	3	54	15	48.3	N	154.5	E	KURILS	2.0	10	60
275	SEP	7	4	45	33	58.7	N	150.0	W	KODIAK ISLAND	0.8	5	35
276	SEP	7	5	8	41	52.7	N	159.2	E	KAMCHATKA	2.0	10	43
*277	SEP	7	7	43		58	N	152	W	KODIAK ISLAND		4	35
278	SEP	7	8	29	34	54.7	N	161.4	E	KAMCHATKA	1.5	9	41
279	SEP	7	10	49	53	43.6	N	131.9	W	CALIFORNIA	2.9	4	22
280	SEP	7	11	59	14	56.7	N	163.0	E	KAMCHATKA	0.9	9	42
281	SEP	7	13	20	41	6.6	S	105.6	W	GALAPAGOS	1.2	4	39
282	SEP	7	13	30	11	6.1	S	107.3	W	GALAPAGOS	0.8	5	47
283	SEP	7	13	33	30	6.4	S	105.7	W	GALAPAGOS	0.4	5	48
284	SEP	7	13	33	56	6.0	S	106.8	W	GALAPAGOS	1.5	4	38
285	SEP	7	13	43	12	7.0	S	105.1	W	GALAPAGOS	1.1	5	50

SER	M	D	H	M	S	LAT	LONG	AREA	SD	NO	DB
286	SEP	7	13	44	20	6.2 S	106.5 W	GALAPAGOS	1.3	4	42
287	SEP	7	15	13	3	6.5 S	106.0 W	GALAPAGOS	0.4	5	49
288	SEP	7	19	41	11	55.2 N	161.0 E	KAMCHATKA	1.5	7	44
289	SEP	7	23	43	54	48.4 N	150.3 E	KURILS	5.8	11	43
290	SEP	8	0	22	36	5.6 S	107.7 W	GALAPAGOS	0.7	5	45
291	SEP	8	4	56	47	50.7 N	156.2 E	KURILS	2.1	8	27
292	SEP	8	8	34	59	40.8 N	127.7 W	SAN ANDREAS EXT	0.8	6	59
293	SEP	8	9	9	2	45.7 N	150.3 E	HOKKAIDO	2.2	7	42
294	SEP	8	9	30	29	47.0 N	148.3 E	HOKKAIDO	2.3	7	44
*295	SEP	8	10	3	17	41.8 N	127.2 W	SAN ANDREAS EXT	1.3	9	48
296	SEP	8	10	49	1	46.9 N	152.1 E	KURILS	2.5	6	26
297	SEP	8	13	39	49	29.0 N	142.1 E	BONIN ISLANDS	1.0	4	20
298	SEP	8	16	49	25	29.3 N	138.8 E	BONIN ISLANDS	4.7	5	22
299	SEP	8	17	14	19	52.9 N	152.3 E	KURILS	7.6	8	60
300	SEP	8	18	14	21	6.7 S	105.9 W	GALAPAGOS	1.1	5	40
301	SEP	8	20	12	31	54.5 N	164.4 E	KOMANDORSKIS	1.8	9	42
302	SEP	8	21	6	44	58.7 N	145.6 W	GULF OF ALASKA	1.4	6	48
303	SEP	9	0	14	47	55.3 N	163.9 E	KOMANDORSKIS	0.5	8	36
304	SEP	9	1	39	18	56.5 N	151.9 W	KODIAK ISLAND	1.7	7	31
305	SEP	9	3	28	19	54.6 N	161.9 E	KAMCHATKA	2.3	11	38
306	SEP	9	3	40	45	54.6 N	161.8 E	KAMCHATKA	3.3	9	30
*307	SEP	9	6	6	14	26.0 N	143.9 E	BONIN ISLANDS	1.8	7	50
308	SEP	9	7	0	23	11.1 N	143.3 E	MARIANAS	0.7	5	53
309	SEP	9	13	14	4	47.4 N	152.7 E	KURILS	5.1	7	28
310	SEP	9	14	5	35	56.1 N	159.1 W	KODIAK ISLAND	1.2	5	21
311	SEP	9	16	24	6	45.5 N	144.1 E	HOKKAIDO	0.6	4	33
312	SEP	9	16	24	26	26.1 N	143.5 E	BONIN ISLANDS	0.8	5	29
313	SEP	9	23	47	28	47.4 N	151.1 E	KURILS	26.0	10	53
314	SEP	10	1	54	9	58.0 N	162.2 E	KAMCHATKA	1.2	8	30
315	SEP	10	2	16	51	55.8 N	165.5 E	KOMANDORSKIS	1.0	4	21
316	SEP	10	2	20		52 N	173 E	KOMANDORSKIS		4	22
317	SEP	10	3	2	49	52.4 N	159.7 E	KAMCHATKA	1.5	11	22
318	SEP	10	3	42		59 N	141 W	GULF OF ALASKA		5	37
319	SEP	10	5	5	14	16.6 S	176.7 E	SAMOA	0.1	4	33
320	SEP	10	11	55	8	42.5 N	146.8 E	HOKKAIDO	2.7	9	53
321	SEP	10	20	52	11	22.7 N	119.2 E	TAIWAN	1.7	6	39
322	SEP	11	0	0	23	28.2 N	137.3 E	BONIN ISLANDS	0.8	4	34
323	SEP	11	0	27	30	58.2 N	144.1 W	GULF OF ALASKA	0.7	5	29
324	SEP	11	1	57	55	55.0 N	161.4 E	KAMCHATKA	3.2	10	42
325	SEP	11	3	4	2	44.4 N	129.3 W	SAN ANDREAS EXT	1.3	7	29
326	SEP	11	3	23	42	31.0 N	140.3 E	BONIN ISLANDS	0.3	6	31
327	SEP	11	5	10	26	21.6 S	74.9 W	JALISCO	4.2	6	45
328	SEP	11	7	26	49	55.2 N	153.8 W	KODIAK ISLAND	0.7	6	39
329	SEP	11	8	6	58	31.4 N	139.1 E	BONIN ISLANDS	0.2	4	30
330	SEP	11	9	13	27	59.9 N	144.4 W	GULF OF ALASKA	0.1	4	22
331	SEP	11	13	50	13	26.4 N	143.3 E	BONIN ISLANDS	1.2	4	17
332	SEP	11	13	50	28	42.8 N	146.4 E	HOKKAIDO	2.0	4	34
333	SEP	11	18	12	46	49.1 N	137.1 W	VANCOUVER	1.3	3	27

SER	M	D	H	M	S	LAT		LONG		AREA	SD	NL	EP
334	SEP	12	0	16		41	N	124	W	CALIFORNIA		6	27
335	SEP	12	1	1	19	51.8	N	160.1	E	KAMCHATKA	1.7	8	29
336	SEP	12	3	10	21	61.5	N	146.4	W	GULF OF ALASKA	0.3	5	25
337	SEP	12	4	33	42	55.7	N	155.9	W	KODIAK ISLAND	0.6	8	38
338	SEP	12	12	49	27	0.2	S	147.6	E	BISMARCK	2.3	4	38
339	SEP	12	17	20	43	53.6	N	162.7	E	KAMCHATKA	4.6	9	29
*340	SEP	12	20	25	18	45.8	N	148.9	E	HOKKAIDO	2.1	9	59
341	SEP	12	21	45	43	21.1	S	117.8	W	SOUTH PACIFIC	2.8	8	63
342	SEP	12	22	49	35	60.3	N	142.8	W	GULF OF ALASKA	1.0	5	39
343	SEP	12	23	18	45	10.5	N	130.4	E	TAIWAN	0.5	4	31
344	SEP	12	23	35	21	5.2	S	151.7	E	BISMARCK	1.0	4	34
345	SEP	13	2	19	50	54.9	N	166.5	E	KOMANDORSKIS	2.1	7	23
346	SEP	13	3	30	52	26.9	N	153.6	E	MARIANAS	0.8	4	18
347	SEP	13	4	56	38	50.1	N	155.6	E	KURILS	1.6	9	42
*348	SEP	13	9	30	3	53.3	N	169.5	E	KOMANDORSKIS	2.4	9	49
349	SEP	13	10	20	56	48.0	N	151.1	E	KURILS	6.2	11	43
350	SEP	13	14	52	21	29.9	S	105.7	W	SOUTH PACIFIC	1.6	4	46
351	SEP	13	15	19	39	47.5	N	153.0	E	KURILS	1.3	11	36
*352	SEP	13	16	56	52	48.4	N	154.6	E	KURILS	2.9	7	31
353	SEP	13	18	7	32	57.4	N	166.2	E	KOMANDORSKIS	7.3	8	28
354	SEP	13	19	18	8	13.5	S	170.3	E	SAMOA	0.5	5	32
*355	SEP	13	22	28	36	56.1	N	162.4	W	KODIAK ISLAND	8.6	12	40
356	SEP	14	1	12	41	55.7	N	152.7	W	KODIAK ISLAND	1.8	8	40
357	SEP	14	3	28	35	57.8	N	147.0	W	KODIAK ISLAND	1.4	4	1
358	SEP	14	3	36	26	55.7	N	163.7	W	KODIAK ISLAND	1.4	4	17
359	SEP	14	4	7	43	2.0	S	157.3	E	BISMARCK	4.2	4	30
360	SEP	14	6	36	22	50.1	N	155.2	E	KURILS	0.8	7	28
361	SEP	14	12	25	11	44.4	N	147.3	E	HOKKAIDO	9.2	9	44
362	SEP	14	13	36	13	51.7	N	153.4	E	KURILS	5.7	11	42
364	SEP	14	16	4	36	55.5	N	153.1	W	KODIAK ISLAND	2.0	11	48
365	SEP	14	16	13	30	51.7	N	164.1	E	KAMCHATKA	1.7	7	27
*366	SEP	14	20	41	1	45.4	N	151.1	E	KURILS	1.8	9	45
367	SEP	14	22	42	54	16.5	N	101.1	W	GUERRERO	3.3	6	49
*368	SEP	15	0	59	2	16.4	S	175.9	W	SAMOA	1.6	6	41
369	SEP	15	1	27	56	17.4	S	175.6	W	SAMOA	5.9	7	37
370	SEP	15	2	48	31	46.8	N	150.8	E	KURILS	4.1	7	30
371	SEP	15	2	49	46	46.5	N	150.3	E	KURILS	2.3	7	29
372	SEP	15	5	12	10	11.4	N	133.8	E	MARIANAS	0.8	5	44
373	SEP	15	16	17	57	56.9	N	137.6	W	QUEEN CHARLOTTE	1.2	10	31
374	SEP	15	17	57		51	N	156	E	KAMCHATKA		10	35
375	SEP	15	18	44	41	48.3	N	15[illegible]	E	KURILS	3.7	9	52
376	SEP	15	20	27	22	44.9	N	151.4	E	HOKKAIDO	3.0	11	36
377	SEP	15	20	27	32	45.6	N	151.3	E	KURILS	3.4	10	33
378	SEP	15	21	53	25	56.2	N	152.4	W	KODIAK ISLAND	2.4	11	49
379	SEP	16	0	1	31	43.8	N	128.4	W	SAN ANDREAS EXT	3.6	10	37
380	SEP	16	1	37	59	47.1	N	151.5	E	KURILS	0.5	6	24
381	SEP	16	2	46	19	61.4	N	140.8	W	GULF OF ALASKA	1.0	6	29

SER	M	D	H	M	S	LAT		LONG		AREA	SD	NO	DD
382	SEP	16	6	34	7	34.9	N	142.4	E	JAPAN	1.0	7	38
383	SEP	16	8	9	11	44.2	N	129.3	W	SAN ANDREAS EXT	3.5	12	59
384	SEP	16	8	12	22	44.7	N	126.9	W	SAN ANDREAS EXT	1.4	7	38
385	SEP	16	8	38	49	56.1	N	151.3	W	KODIAK ISLAND	0.9	7	34
386	SEP	16	9	12	18	16.1	N	98.0	W	GUERRERO	1.4	5	37
387	SEP	16	9	51	23	46.1	N	149.3	E	HOKKAIDO	0.9	4	26
388	SEP	16	9	57	20	47.4	N	152.1	E	KURILS	6.6	10	47
389	SEP	16	17	1	12	57.6	N	149.3	W	KODIAK ISLAND	0.8	5	36
390	SEP	16	21	0	21	44.8	N	149.1	E	HOKKAIDO	2.5	10	35
*391	SEP	16	22	40	1	54.1	N	164.4	E	KOMANDORSKIS	1.1	11	52
*392	SEP	17	5	56	47	27.7	N	143.2	E	BONIN ISLANDS	0.5	5	18
393	SEP	17	6	41	22	56.7	N	150.0	W	KODIAK ISLAND	2.1	7	45
394	SEP	17	6	45	38	28.4	N	129.7	E	TAIWAN	13.3	6	31
395	SEP	17	7	24	17	15.6	S	176.6	E	SAMOA	0.3	5	34
396	SEP	17	7	39	12	16.9	S	71.1	W	PERU	4.7	7	44
397	SEP	17	10	11	55	44.3	N	129.0	W	SAN ANDREAS EXT	3.6	10	45
398	SEP	17	10	38	56	54.8	N	164.2	E	KOMANDORSKIS	0.7	9	40
399	SEP	17	10	46	42	52.8	N	170.1	E	KOMANDORSKIS	1.0	9	32
400	SEP	17	13	4	44	56.0	N	152.1	W	KODIAK ISLAND	0.5	6	39
401	SEP	17	13	4	51	54.5	N	153.3	W	KODIAK ISLAND	1.3	7	42
402	SEP	17	15	28	29	43.1	N	146.5	E	HOKKAIDO	2.6	10	44
403	SEP	17	15	32	13	53.8	N	154.3	W	KODIAK ISLAND	0.9	5	28
404	SEP	17	15	32	44	53.7	N	154.4	W	KODIAK ISLAND	0.5	5	34
405	SEP	17	16	45	36	45.5	N	125.8	W	SAN ANDREAS EXT	15.0	11	47
406	SEP	17	21	28	32	32.1	N	122.9	W	CALIFORNIA	1.5	8	42
407	SEP	17	22	37	58	53.5	N	164.8	E	KOMANDORSKIS	1.6	8	25
408	SEP	17	23	49	1	53.5	N	164.7	E	KOMANDORSKIS	1.5	9	52
409	SEP	18	1	24	44	46.7	N	152.0	E	KURILS	7.0	9	28
410	SEP	18	2	38	11	48.2	N	154.7	E	KURILS	3.0	10	40
411	SEP	18	7	46	13	17.7	N	102.3	W	GUERRERO	1.1	5	28
412	SEP	18	10	26	10	19.5	N	156.3	W	HAWAII	0.8	6	55
413	SEP	18	10	54	47	27.0	N	148.5	E	BONIN ISLANDS	0.4	4	23
414	SEP	18	12	7	45	60.9	N	141.5	W	GULF OF ALASKA	0.8	5	41
415	SEP	18	14	39	24	55.5	N	151.4	W	KODIAK ISLAND	3.2	10	44
416	SEP	18	15	42	9	54.9	N	163.9	E	KAMCHATKA	1.5	7	21
417	SEP	18	16	24	19	57.0	N	155.6	E	KAMCHATKA	7.7	7	32
418	SEP	18	21	55	48	54.9	N	164.0	E	KAMCHATKA	1.5	9	45
419	SEP	19	0	15	21	57.5	N	171.2	E	KOMANDORSKIS	2.2	11	19
420	SEP	19	2	54	27	45.4	N	123.5	W	SAN ANDREAS EXT	2.7	11	49
421	SEP	19	3	7	37	50.2	N	167.9	E	KOMANDORSKIS	1.0	4	16
422	SEP	19	3	58	7	10.4	N	130.4	E	TAIWAN	0.6	4	32
423	SEP	19	6	52		44	N	145	E	HOKKAIDO		9	48
424	SEP	19	10	41	36	60.6	N	141.0	W	GULF OF ALASKA	1.0	5	30
425	SEP	19	12	32	56	47.0	N	151.6	E	KURILS	2.6	10	41
*426	SEP	19	17	27		5	S	82	W	PERU		7	50
427	SEP	19	23	10	29	41.1	N	127.4	W	SAN ANDREAS EXT	1.8	11	45
428	SEP	19	23	44	31	50.3	N	130.3	W	VANCOUVER	0.8	8	37
429	SEP	19	23	50	8	50.5	N	130.4	W	VANCOUVER	7.9	12	42

SER	M	D	H	M	S	LAT	LONG	AREA	SD	NO	DB
430	SEP	20	0	11	50	41.2 N	127.3 W	SAN ANDREAS EXT	1.9	5	39
431	SEP	20	0	39	14	41.1 N	127.4 W	SAN ANDREAS EXT	0.9	9	28
432	SEP	20	1	5	56	41.8 N	127.1 W	SAN ANDREAS EXT	5.6	10	33
433	SEP	20	1	52	21	41.2 N	127.3 W	SAN ANDREAS EXT	0.6	4	37
434	SEP	20	2	5	6	41.2 N	127.3 W	SAN ANDREAS EXT	0.3	5	42
435	SEP	20	2	36	16	41.2 N	127.4 W	SAN ANDREAS EXT	1.2	12	36
436	SEP	20	2	37	9	41.1 N	127.4 W	SAN ANDREAS EXT	1.9	13	38
437	SEP	20	2	46	28	41.2 N	127.4 W	SAN ANDREAS EXT	1.7	10	43
438	SEP	20	3	37	31	52.4 S	107.2 W	SOUTH PACIFIC	0.7	5	[illegible]
439	SEP	20	3	44	59	58.7 N	145.3 W	GULF OF ALASKA	1.7	6	49
*440	SEP	20	4	20	36	49.3 S	116.5 W	SOUTH PACIFIC	1.0	6	59
*441	SEP	20	4	33	37	49.3 S	116.5 W	SOUTH PACIFIC	1.6	6	74
442	SEP	20	4	48	40	49.9 S	115.6 W	SOUTH PACIFIC	0.4	4	70
443	SEP	20	5	33	40	51.1 N	156.5 E	KURILS	1.3	8	42
*444	SEP	20	7	42	7	41.2 N	127.4 W	SAN ANDREAS EXT	1.3	13	49
445	SEP	20	7	43	3	41.1 N	127.4 W	SAN ANDREAS EXT	1.3	13	50
446	SEP	20	9	20	40	41.3 N	127.4 W	SAN ANDREAS EXT	5.9	7	29
447	SEP	20	9	30	42	41.4 N	127.3 W	SAN ANDREAS EXT	10.2	7	29
448	SEP	20	9	32	12	41.0 N	127.4 W	SAN ANDREAS EXT	4.6	7	27
449	SEP	20	10	28	58	41.1 N	127.4 W	SAN ANDREAS EXT	1.2	9	31
450	SEP	20	15	1	1	41.1 N	127.4 W	SAN ANDREAS EXT	3.6	5	28
451	SEP	20	15	28	35	41.1 N	127.4 W	SAN ANDREAS EXT	1.1	7	32
452	SEP	20	16	16	34	41.1 N	127.4 W	SAN ANDREAS EXT	1.2	4	30
*453	SEP	20	20	42	37	23.6 N	120.8 E	TAIWAN	1.9	5	48
454	SEP	20	20	54	19	49.2 N	156.3 E	KURILS	1.0	6	40
455	SEP	21	2	51	7	22.0 N	122.2 E	TAIWAN	2.2	7	40
456	SEP	21	3	48	40	21.8 N	120.1 E	TAIWAN	9.6	6	29
457	SEP	21	4	34	26	57.3 N	149.7 W	KODIAK ISLAND	1.9	5	26
458	SEP	21	12	10	13	37.3 N	140.9 E	JAPAN	4.7	6	35
459	SEP	21	12	43	57	40.7 N	127.6 W	SAN ANDREAS EXT	1.7	8	44
460	SEP	21	14	11	53	50.3 N	156.8 E	KURILS	1.6	10	35
*461	SEP	21	16	29	39	48.0 N	153.2 E	KURILS	2.4	11	61
462	SEP	21	16	41	50	47.9 N	153.3 E	KURILS	1.1	11	47
463	SEP	21	17	4		48 N	151 E	KURILS		7	27
464	SEP	21	17	14	56	48.0 N	153.2 E	KURILS	1.7	10	34
465	SEP	21	17	19	46	47.9 N	153.3 E	KURILS	0.5	6	20
466	SEP	21	17	31	8	46.4 N	151.2 E	KURILS	3.1	5	24
467	SEP	21	18	25	1	47.9 N	153.4 E	KURILS	1.3	10	35
468	SEP	21	18	27	59	48.3 N	152.9 E	KURILS	1.5	7	30
469	SEP	21	18	38	1	47.8 N	153.4 E	KURILS	1.5	9	40
470	SEP	21	19	8	44	48.2 N	152.9 E	KURILS	1.8	10	40

TABLE III / PAGE 1

EXPLOSIONS LOCATED BY SOFAR ARRIVAL 17 TO 21 SEP 1964
ALEUTIAN AIR DROPS

SER	M	D	H	M	S	LAT		LONG		AREA	SD	NO	DB
65	SEP	17	22	59	54	51.5	N	176.6	W	EAST ALEUTIANS	1.3	11	73
66	SEP	17	23	14	54	51.3	N	176.6	W	EAST ALEUTIANS	3.5	11	55
67	SEP	17	23	31	36	51.2	N	176.6	W	EAST ALEUTIANS	3.0	11	48
68	SEP	17	23	45	28	51.0	N	176.6	W	EAST ALEUTIANS	2.9	11	48
69	SEP	18	0	30	29	51.0	N	176.5	W	EAST ALEUTIANS	2.7	13	71
70	SEP	18	0	44	42	50.8	N	176.6	W	EAST ALEUTIANS	2.2	13	72
71	SEP	18	1	0	15	50.7	N	176.6	W	EAST ALEUTIANS	2.9	12	73
72	SEP	18	1	15	20	50.4	N	176.6	W	EAST ALEUTIANS	2.6	13	72
80	SEP	20	19	44	7	51.5	N	178.3	W	EAST ALEUTIANS	4.8	6	49
79	SEP	20	20	23	8	51.2	N	177.9	W	EAST ALEUTIANS	0.9	10	63
78	SEP	20	20	32	44	51.4	N	177.5	W	EAST ALEUTIANS	1.1	9	75
77	SEP	20	20	46	57	51.5	N	177.2	W	EAST ALEUTIANS	1.1	9	61
76	SEP	20	21	32	47	51.6	N	176.2	W	EAST ALEUTIANS	1.3	10	75
74	SEP	20	21	50	8	52.0	N	175.4	W	EAST ALEUTIANS	1.3	10	55
73	SEP	20	21	59	56	51.9	N	174.8	W	EAST ALEUTIANS	1.1	11	56
75	SEP	20	22	36	33	51.7	N	175.9	W	EAST ALEUTIANS	1.3	11	74
81	SEP	20	23	23	25	51.4	N	178.7	W	EAST ALEUTIANS	2.7	11	59
82	SEP	20	23	52	26	51.2	N	179.4	W	EAST ALEUTIANS	1.8	11	57
83	SEP	21	0	18	22	51.0	N	179.6	E	WEST ALEUTIANS	1.8	11	55
84	SEP	21	0	40	55	51.5	N	178.9	E	WEST ALEUTIANS	0.5	9	60
16	SEP	21	1	5	20	50.9	N	179.3	E	WEST ALEUTIANS	2.5	10	74
-0		-0	-0	-0		-0		-0				-0	-0

END-OF-DATA ENCOUNTERED ON SYSTEM INPUT FILE.

Table IV

C&GS Epicenters Corresponding to Events in Table I

Date (1964)	Time (GMT)	Latitude	Longitude	h, km	Magnitude (C&GS)
Aug. 15	02 29 28*	50.7 N	179.4 E	33	4.1
Aug. 17	12 41 58*	50.0 N	171.8 W	33	4.5
Aug. 17	16 38 44.4	51.5 N	177.8 E	42	5.4
Aug. 17	21 41 46*	51.7 N	167.7 W	33	4.9
Aug. 27	03 10 19*	54.1 N	167.4 W	33	4.3
Aug. 31	23 20 19.4	52.4 N	170.7 W	33	5.2
Sep. 1	17 16 40.4	51.2 N	170.6 W	25	5.5
Sep. 4	18 37 32.6	51.7 N	174.7 E	33	4.4
Sep. 6	10 29 51.4	53.9 N	163.9 W	33	—
Sep. 14	11 35 54*	53.6 N	170.3 W	50	3.8
Sep. 16	03 32 34*	51.6 N	173.8 W	45	4.2
Sep. 18	12 22 13.3	51.4 N	179.9 W	33	4.8

* Notation of the Coast and Geodetic Survey.

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13 ABSTRACT

This report tabulates sources and strengths of earthquake T phases recorded by hydrophone net during the VELA UNIFORM Aleutian Islands Experiment (August-September, 1964). In a thirty-seven day period, 654 earthquake locations were found for the entire Pacific, of which 184 were in the Aleutians. Comparison of T-phase strengths with earthquake magnitudes suggests a threshold about magnitude three for location by hydrophone net.

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SOFAR						

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